

REMARKS

Claim 1 has been amended to recite that resin (2) is present in an amount of from 3 to [25] 5 parts by weight per 100 parts by weight of resin (1). Support is found, for example, in Table 4 at page 23 of the specification.

Review and reconsideration on the merits are requested.

Claims 1, 7 and 14-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 2003-096285 (JP '285) in view of WO 03/0065502 to Kuroki et al (using U.S. 6,984,443 as an English language equivalent).

Claims 1, 7 and 14-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '285 in view of U.S. Patent 5,247,013 to Shinoda.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '285 and Kuroki et al or JP '285 and Shinoda et al further inv view of JP 08073628 (JP '628).

The grounds for rejection remain the same as set forth in the previous Office Action.

In the Response filed November 14, 2007, Applicants submitted supplemental test data in a second Declaration Under 37 C.F.R. § 1.312 dated November 16, 2007 as to criticality in the claimed range of resin (2) relative to resin (1).

In the Response to Arguments in paragraph 5 at pages 3-4 of the Office Action dated December 7, 2007, the Examiner maintained that the prior art teaches that addition of resin (2) relative to resin (1) is a result-effective variable, and disagreed that the test data (as presented in the second Declaration Under 37 C.F.R. § 1.312 dated November 16, 2007) establishes criticality in the claimed range. Moreover, the Examiner was of the view that the test data did not show unexpected results.

Instead, as a basis for patentability, the Examiner suggested submission of additional test data showing that it is the combination of L-lactic acid (homopolymer) and D-lactic acid copolymer with saccharide which provides the effects of the invention, as opposed to blending with a saccharide alone or blending with D-lactic acid (homopolymer) alone.

In response, Applicants have limited resin (2) in claim 1 to an amount of from 3 to 5 parts by weight per 100 parts by weight of resin (1), and present herein supplemental test data in a third Declaration Under 37 C.F.R. § 1.312 pursuant to the Examiner's suggestion as follows.

(1) Samples requested at page 3 of the Office Action dated December 7, 2007:

- 1-(a): 100 parts L-lactic acid homopolymer, blended with 1 part saccharide
- 1-(b): 100 parts L-lactic acid homopolymer, blended with 1 part D-lactic acid homopolymer
- 1-(c): 100 parts L-lactic acid homopolymer, blended with 1 part D-lactic-co-saccharide

The composition of the above Sample No. 1-(c) corresponds to Sample No. 14 in Table 4' of the second Declaration under 37 C.F.R. § 1.132 dated November 16, 2007.

(2) Samples requested in page 4 of Office Action:

- 2-(a): 100 parts L-lactic acid homopolymer
- 2-(b): 100 parts D-lactic-co-saccharide
- 2-(c): 100 parts D-lactic acid homopolymer
- 2-(d): 100 parts L-lactic acid homopolymer, blended with 25 parts D-lactic acid homopolymer
- 2-(e): 100 parts L-lactic acid homopolymer, blended with 30 parts D-lactic acid homopolymer
- 2-(f): 100 parts L-lactic acid homopolymer, blended with 25 parts D-lactic-co-saccharide
- 2-(g): 100 parts L-lactic acid homopolymer, blended with 30 parts D-lactic-co-saccharide

The compositions of the above Samples Nos. 2-(f) and 2-(g) correspond to Sample Nos. 18 and 19 in Table 4', respectively.

(3) Additional Samples:

- 18: 100 parts L-lactic acid homopolymer, blended with 3 parts D-lactic acid homopolymer
- 19: 100 parts L-lactic acid homopolymer, blended with 5 parts D-lactic acid homopolymer
- 20: 100 parts L-lactic acid homopolymer, blended with 11 parts D-lactic acid homopolymer

Add. Ex.: 100 parts L-lactic acid homopolymer, blended with 3 parts saccharide

The samples thus prepared were evaluated with respect to Tensile strength (MPa), Elongation (%), Melting point (°C) and Crystallization rate, the results of which are set forth in the Table shown below. Maximum Tensile strength and Elongation at break were evaluated as described at page 24 of the specification. The test data presented in the Declaration submitted herewith is reproduced below, as follows.

	2-(a)	2-(b)	2-(c)	1-(c)	15	16	17	2-(f)	2-(g)	1-(a)	Add. Ex
Resin (1)	100	-	-	100	100	100	100	100	100	100	100
Resin (2)	-	100	-	1	3	5	11	25	30	-	-
Resin (3)	-	-	100	-	-	-	-	-	-	-	-
Starch	-	-	-	-	-	-	-	-	-	1	3
Tensile strength (MPa)	-	-	-	53	53	48	15	7.4	8.1		
Elongation (%)	-	-	-	4.2	4.1	3.5	1	0.5	0.6		
Melting point (°C)	184.9	134.4	127.4	185.2	185.7	186.2	190	200 ≤	200 ≤	183.7	186
Crystallization rate	Small	Small	Small	Small	Medium	Large	Large	Large	Large	Small	Small

	1-(b)	18	19	20	2-(d)	2-(e)
Resin (1)	100	100	100	100	100	100
Resin (2)	-	-	-	-	-	-
Resin (3)	1	3	5	11	25	30
Tensile strength (MPa)	57	34	35	15	6.4	4.5
Elongation (%)	4.9	2.5	2.7	1	0.4	0.3
Melting point (°C)	184.3	185.1	183.9	190	200 ≤	200 ≤
Crystallization rate	Small	Small	Small	Large	Large	Large

Resin (1): Homopolymer of L-lactic acid (Lacea H-100J), which is the same as used in Example 5
Resin (2): Copolymer of D-lactic acid and corn starch, which is the same as used in Example 5
Resin (3): Homopolymer of D-lactic acid, the D-lactic acid being 90% D-lactic acid manufactured by Purac
Starch: Corn starch

Applicants comment on the significance of the test data as follows.

- (a) If the amount of resin (2) is 1 part by weight, the composition results in a small crystallization rate (Sample No. 1-(a)).
- (b) If the amount of resin (2) exceeds 5 parts by weight, the material cost is increased and also the tensile strength and elongation are lowered (Sample Nos. 17, 2-(f) and 2(g)).
- (c) The stereocomplex of L-lactic acid and D-lactic acid is known. However, the formulation of L-lactic acid and D-lactic-co-saccharide is novel. With the addition of 3 to 5 parts by weight of the copolymer, a crystallization rate suitable for productivity was achieved. In the case of formulation of L-lactic acid with D-lactic acid, the crystallization rate is small, and further, the tensile strength and the elongation are deteriorated.

Significance of the Difference in Crystallization Rate:

Sample Nos. 15 and 16 according to the invention have a crystallization rate of “medium” or higher. To the contrary, Sample Nos. 18 and 19 representing ordinary stereocomplex materials have a crystallization rate of “small.” A crystallization rate of “medium” or higher enables an increase in the molding cycle speed, which leads to cost reduction.

Significant Differences in Tensile Strength and Elongation Represent an Advance in the Art:

Resin materials generally used for automobiles are ABS and PP. Tensile test data (i.e., tensile strength and elongation measured in the same manner) for ABS and PP are additionally given below.

	General-purpose automobile material	
	ABS ⁽⁺¹⁾	PP ⁽⁺²⁾
Tensile Strength (MPa)	44	34
Elongation (%)	16	10

*1: ABS used is A330 available from Techno Polymer Co., Ltd.

*2: PP used is Nobrene BZH-51 available from Sumitomo Chemical Co., Ltd.

Comparing the results, it can be seen that Sample Nos. 15 and 16 according to the invention exhibit a higher tensile strength than that of ABS which is of itself required to have a high tensile strength among materials for automobile parts. To the contrary, Sample Nos. 18 and 19 have a tensile strength as low as that of PP. Accordingly, although conventional polylactic acid materials have been applicable only to the extent of PP, the present invention extends applicability, in terms of tensile strength, up to that provided by ABS. This is a surprising and unexpected effect of the invention.

As to criticality in the claimed range of 3 to 5 parts by weight of resin (2) per 100 parts by weight of resin (1), the test data presented in the third Declaration shows that only the samples in the invention, i.e., Sample Nos. 15 and 16, provided both high tensile strength and elongation in addition to a medium or large crystallization rate. Sample No. 1-(c) containing resin (2) in an amount of 1 part by weight per 100 parts by weight of resin (1) provided only a small crystallization rate and therefore lower productivity. On the other hand, in Sample Nos. 17, 2-(f) and 2-(g) where resin (2) was present in amounts exceeding 5 parts by weight per 100 parts by weight of resin (1), the crystallization rate (productivity) was large, but the resulting resin compositions suffered from reduced tensile strength and elongation.

Sample Nos. 2-(a), 2-(b) and 2-(c) consisting of resin (1), resin (2) or resin (3) alone did not provide the effects of the invention (small crystallization rate). Also, Sample No. 1-(a) and

Add. Ex. consisting of 100 parts by weight of resin (1) and 1 or 3 parts by weight of starch, also did not provide the effects of the invention (small crystallization rate).

Sample Nos. 1-(b), 18 and 19, having a composition containing resin (3) in amounts of 1, 3 or 5 parts by weight per 100 parts by weight of resin (1), respectively, did not provide the effects of the invention (small crystallization rate). Resin (3) is a homopolymer of D-lactic acid. Sample Nos. 20, 2-(d) and 2-(e) having a composition of 11, 25 or 30 parts of resin (3) per 100 parts by weight of resin (1), respectively, exhibited a large crystallization rate but suffered in terms of low tensile strength and elongation. Likewise, these samples also did not achieve the effects of the invention.

Namely, in exhaustive testing, Applicants have demonstrated criticality in the claimed resin composition containing resin (2) in an amount of from 3 to 5 parts by weight per 100 parts by weight of resin (1).

The above noted results establish criticality in the claimed range and are unexpectedly superior over the prior art relied upon by the Examiner.

To the extent that the Examiner was of the view that addition of resin (2) relative to resin (1) is a result-effective variable, Applicants respectfully disagree. There is nothing in the prior art that teaches that the addition amount of resin (2) relative to resin (1) is a result-effective variable for providing high tensile strength and elongation *as well as* a suitably high crystallization rate, or otherwise. In view of the amendment to the claims, the test data presented in the third Declaration Under 37 C.F.R. § 1.312 submitted herewith and the above remarks, it is respectfully submitted that the present claims are patentable over the cited prior art, and withdrawal of the foregoing rejections is respectfully requested.

Withdrawal of all rejections and allowance of claims 1, 7, 9 and 14-16 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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